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VOPAK PORT BOTANY EXPANSION – DENISON ST TRANSPORT QRA – JULY 2016 UPDATE

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JULY 2016 UPDATE

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1. INTRODUCTION AND SCOPE OF REPORT

1.1 Background

Scott Lister has previously performed a Quantitative Risk Assessment (QRA) for the transport of Dangerous Goods along Denison St, Hillsdale. This report was prepared on behalf of the Department of Planning (DPE) and Botany Council as part of the risk assessment review of the Bunnings development and issued on the 12th of February, 2015. This study was subsequently updated and an addendum was issued on the 18th of May 2015.

These studies quantified the risk from the transport of Dangerous Goods along Denison St. The majority of these movements are associated with either the Botany Industrial Park (BIP) or Port Botany.

Vopak is proposing to expand exports from its Port Botany Terminal and as a result, an increase in Dangerous Goods (DG) traffic along Denison St can be expected. This report summarises the results of a quantitative risk study of the impact of increased DG traffic along Denison St.

1.2 Vopak Expansion

Vopak operates the Sydney Site B petroleum fuel terminal within the Port Botany precinct. Vopak is proposing to increase the petroleum fuels throughput from 3,950ML/year to 7,800ML/year. The associated total road tanker export capacity is proposed to increase from 1,897ML/year in 2013 to 3,700ML in 2023. The remaining petroleum fuels are to be exported via ship or pipeline.

Scott Lister has updated the previous studies undertaken for Denison Street to assess the risk posed by the increase in petroleum fuels associated with the Vopak proposal. The QRA model has also been updated to account for incremental population growth in the vicinity since the 2015 Transport QRA was prepared. This report should be read in conjunction with the initial February 2015 report and the May 2015 addendum.

2. METHODOLOGY

This study is an update of the original Dangerous Goods (DG) Transport QRA for Denison St. Only two parameters have been changed from that study:

- Incremental population growth;
- Number of Class 3 road tankers heading north along Denison St that are not associated with the BIP.

All other parameters such as weather, DG truck movements associated with BIP or other land uses, crash rates and release frequencies and risk criteria are unchanged. The parameters used were generic industry data. They have not been modified to account for any specific risk reduction measures that may be applied. The impact of risk reduction measures such as changes to codes, standards or licensing has not been modelled as the application and impact of these would need to be considered across the industry, and not just specific to Vopak.

Consistent with the original Denison St study, the risk acceptability criteria used for this update are those detailed in the DPE's Hazardous Industry Planning Advisory Paper No.4, *Risk Criteria for Land Use Safety Planning* [HIPAP4 - Ref 003]. The DPE does not have any formal published criteria for transport risk but for the original Denison St report, the HIPAP4 criteria for fixed installations were accepted by the Department as providing a reasonable basis to inform planning decisions.

The risk model is presented for three cases:

- **Base Case**, which is based on 2015 Denison St DG Transport Addendum QRA with traffic based on the 2012 ROAR traffic data count. This case includes an increase in the surrounding residential population due to incremental developments that have occurred or are proposed in the Denison St area. i.e. the populations are higher than the 2015 Addendum QRA, but the truck movements are the same as the 2015 Addendum Case
- **Vopak 2016 Case**, which is the Base Case above, with an increased number of Vopak Class 3 movements based on Vopak operational data.
- **Vopak 2023 Case**, which is the Base Case above, with expanded Vopak Class 3 movements predicted for 2023.

2.1 Population

The suburbs around Denison St include:

- Within Botany Bay City Council:
  - Hillsdale;
  - Eastgardens;
  - Banksmeadow; and
- Within Randwick City Council
  - Matraville.

These suburbs have seen urban consolidation and growth over recent years. For the original Dangerous Goods Transport QRA, the surrounding population was based upon the 2011 Census and several known developments. For this update, a comprehensive review of the local population was performed.

This was done by using the same 2011 Census population as was used in the 2015 studies and also including all approved or proposed Development Applications lodged within the 500m of Denison St that will likely increase the population in the area. 500m was selected as a distance significantly exceeding the area over which there would be any impact from the Class 3 Dangerous Goods that are the subject of the expansion. A map of the search area (for new developments) is shown as Figure 1. A summary of additional populations is included in Table 1.

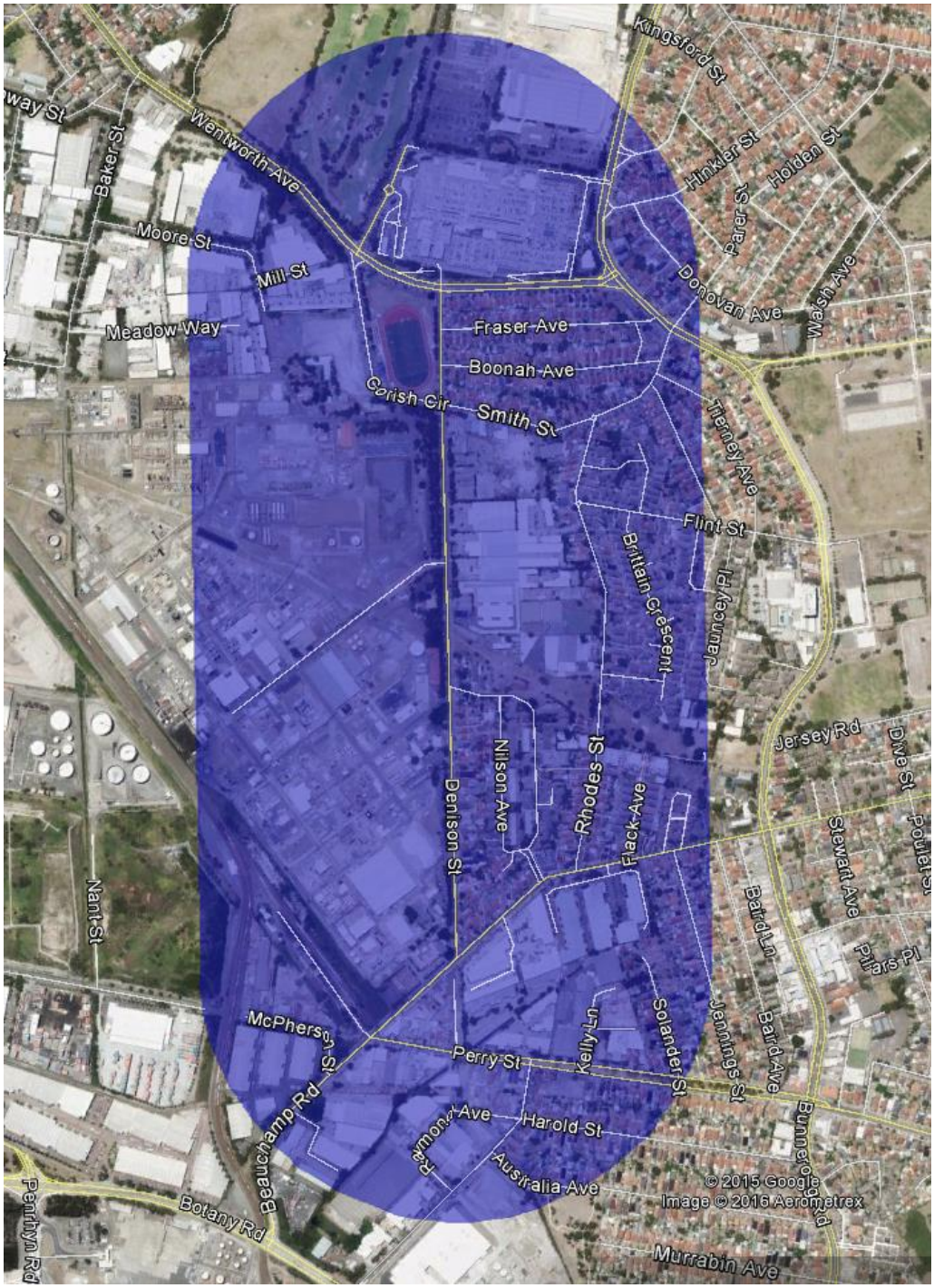

Figure 1. Search Area for Development Applications

Table 1. Additional Populations

ADDRESS	SUBURB	LGA	DAY POPULATION*	NIGHT POPULATION*	REMARKS
Former British American Tobacco Australia Site	Eastgardens	Botany Bay	880	4400	2200 Units, distant from Denison St
22 Rhodes St	Hillsdale	Botany Bay	56	282	141 Units
39-47 Rhodes St	Hillsdale	Botany Bay	50	492	246 Units
41-45 Rhodes St	Hillsdale	Botany Bay	10	96	46 Units
51-53 Rhodes	Hillsdale	Botany Bay	17	170	
32 Page St	Banksmeadow	Botany Bay	106	528	36 townhouses, 221 apartments Units, More than 500m from Denison St
Orica 20 lot subdivision	Banksmeadow	Botany Bay	65	7	
49 Smith St	Hillsdale	Botany Bay	200	0	
Eastgardens shopping centre	Eastgardens	Botany Bay	140		Level 3 expansion
Eastgardens shopping centre	Eastgardens	Botany Bay	150	0	5 new restaurants on ground level. Assumed 30 pax per restaurant.
42 Beauchamp Rd	Hillsdale	Botany Bay	1	7	3 townhouses (2x3bedroom, 1x4bedroom)

ADDRESS	SUBURB	LGA	DAY POPULATION*	NIGHT POPULATION*	REMARKS
47 Boonah	Eastgardens	Botany Bay	1	2	Addition of Granny Flat
73-75 Corish Circle	Banksmeadow	Botany Bay	15	15	05:00hrs to 00:00hrs
50 Beauchamp	Hillsdale	Botany Bay	5	22	9xTownhouses
54A Denison	Hillsdale	Botany Bay	1	4	Addition of first floor (3xbedrooms)
70 Denison	Hillsdale	Botany Bay	1	4	2xbedroom secondary development
15 Solander	Matraville	Randwick	1	5	2xtownhouse
52 Baird	Matraville	Randwick	1	2	New secondary dwelling
2 Kelly	Matraville	Randwick	10	0	2 Detached building for offices
2 Kelly	Matraville	Randwick	1	7	3 townhouses (2x3bedroom, 1x4bedroom)

* Populations are based on 50% of time being 'Day', 50% 'Night'. The numbers quoted are the assumed average number of people present for those 12 hour periods. In the risk model these are the assumed numbers of people present at any one time and for the full duration of those 12 hour periods.

2.2 Tanker Movements

The number of Class 3 and Class 2.1 trucks estimated to use Denison St heading north from Port Botany was advised by Vopak to be those presented in Table 2 below. Further details are provided in Section 3 of Sherpa Consulting Pty Ltd, SITE B PROPOSED THROUGHPUT INCREASE S75W APPLICATION, DANGEROUS GOODS ROAD TRANSPORT RISK ASSESSMENT Rev 3, July 2016.

Table 2. Class 3 and Class 2.1 truck movements

CASE	OPERATOR	ROAD TANKERS HEADING NORTH UP DENISON ST (PER YEAR)	
		CLASS 3	CLASS 2.1
Base Case (2015 Addendum QRA results based on 2012 ROAR traffic count data)	Vopak	3,320	-
	Others	1,086	4,521
	Total	**4,406**	**4,521**
Vopak 2016 Case	Vopak	4,298	-
	Others	1,086	4,521
	Total	**5,384**	**4,521**
Vopak Future Case (2023)	Vopak	6,625	-
	Others	1,086	4,521
	Total	**7,712**	**4,521**
Increase in Vopak movements from Base Case (2015) to Future Case (2023)	**Vopak**	**3,305**	-
Increase in Vopak movements from 2016 Case (2016) to Future Case (2023)	**Vopak**	**2,327**	-

3. RESULTS

3.1 Individual Risk

The Individual Fatality Risks (IFR) from the modelled scenarios are shown over the following pages. Table 3 presents a list of figures.

Table 3. List of IFR Figures

FIGURE	SCENARIO	DESCRIPTION
2	Base Case (2015)	IFR from all DG movements on Denison St
3	Base Case (2015)	IFR from Vopak's DG movements on Denison St
4	Vopak Current Case (2016)	IFR from all DG movements on Denison St
5	Vopak Current Case (2016)	IFR from Vopak's DG movements on Denison St
6	Vopak Future Case (2023)	IFR from all DG movements on Denison St
7	Vopak Future Case (2023)	IFR from Vopak's DG movements on Denison St
8	-	Incremental increase in IFR from Vopak's Future Case (2023) compared to the Base Case (2015)
9	-	Incremental increase in IFR from Vopak's Future Case (2023) compared to the Vopak Current Case (2016)

There is a slight increase in the near field risk from Base Case (Figures 2 & 3) to the Vopak 2016 Case (Figures 4 & 5), and from the Vopak 2016 (Figures 4 & 5) Case to the Vopak 2023 Case (Figures 6 & 7). This is shown by a slight enlargement of the contours around the Wentworth Avenue and Gate 3 intersections.

There is no increase in the far field risk. This is because the far field consequences are driven mostly by releases of Chlorine from truck movements associated with the BIP.

Figure 2. Individual Fatality Risk Results for the Base Case, from all DG movements

Figure 3. Individual Fatality Risk Results for the Base Case, from Vopak's movements only

Figure 4. Individual Fatality Risk Results for the Vopak 2016 Case, from all DG movements

Figure 5. Individual Fatality Risk Results for the Vopak 2016 Case, from Vopak's movements only

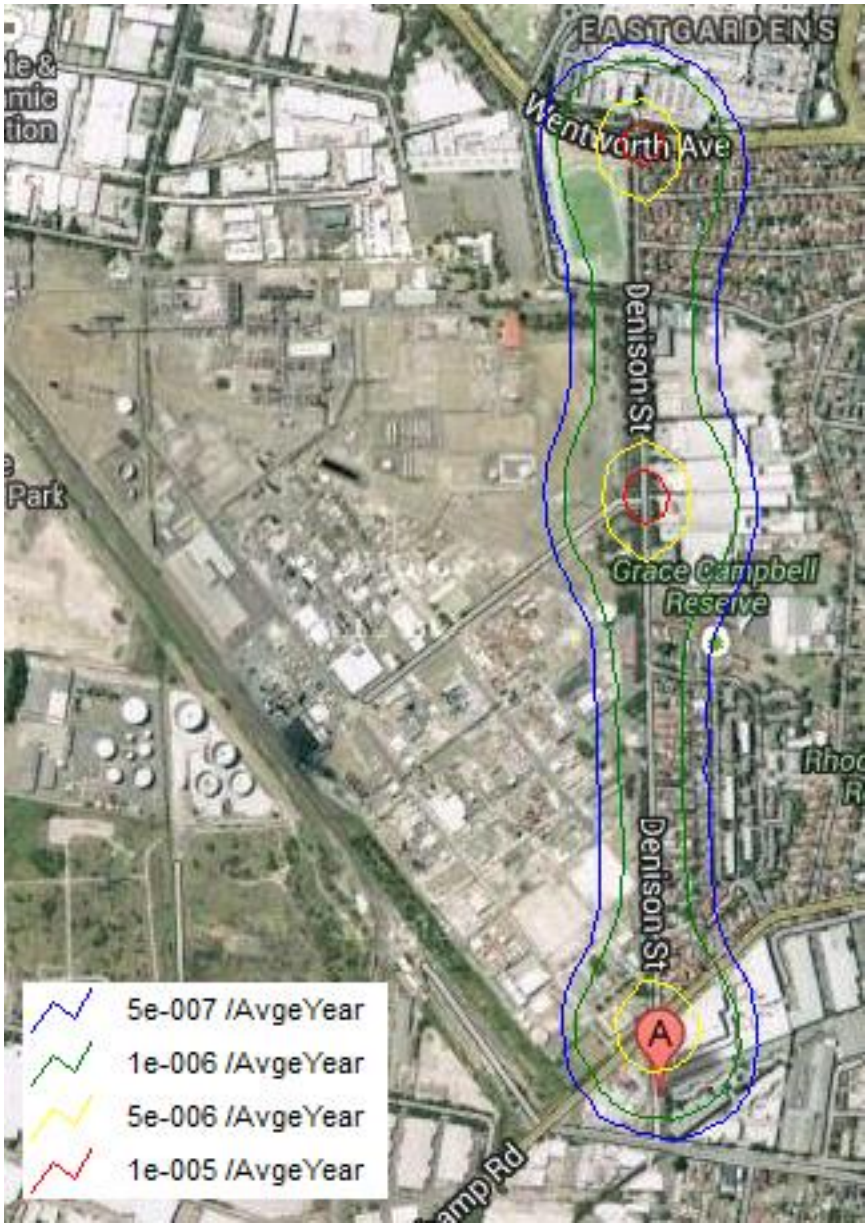

Figure 6. Individual Fatality Risk Results for the Vopak 2023 Case, from all DG movements

Figure 7. Individual Fatality Risk Results for the Vopak 2023 Case, from Vopak's movements only

Figure 8. Incremental Individual Fatality Risk increase from Vopak's DG movements in 2023, with respect to the Base Case

Figure 9. Incremental Individual Fatality Risk increase from Vopak's DG movements in 2023, with respect to the 2016 Case

3.2 Societal Risk

The F-N Curves showing the risk from Vopak truck movements only are shown in Figure 10. These curves are, in all cases, below the yellow line that signifies the negligible region. These curves only extend along the x-axis to a maximum of four fatalities. This is because DG Class 3 incidents tend to have very localised fire effects

The F-N Curves showing the risk from all DG movements on Denison St are shown in Figure 11. The Vopak 2023 Case is shown in black and obscures the other curves, except at the very left of the chart. The Vopak 2016 Case is shown in orange and the Base Case is shown in blue. That the curves are on top of each other for most of their length, reflects the fact that an increase in Class 3 movements will not affect the likelihood of an incident with more than four fatalities. The increase in Vopak's Class 3 movements has only a slight increase in the likelihood of an incident with four or less fatalities.

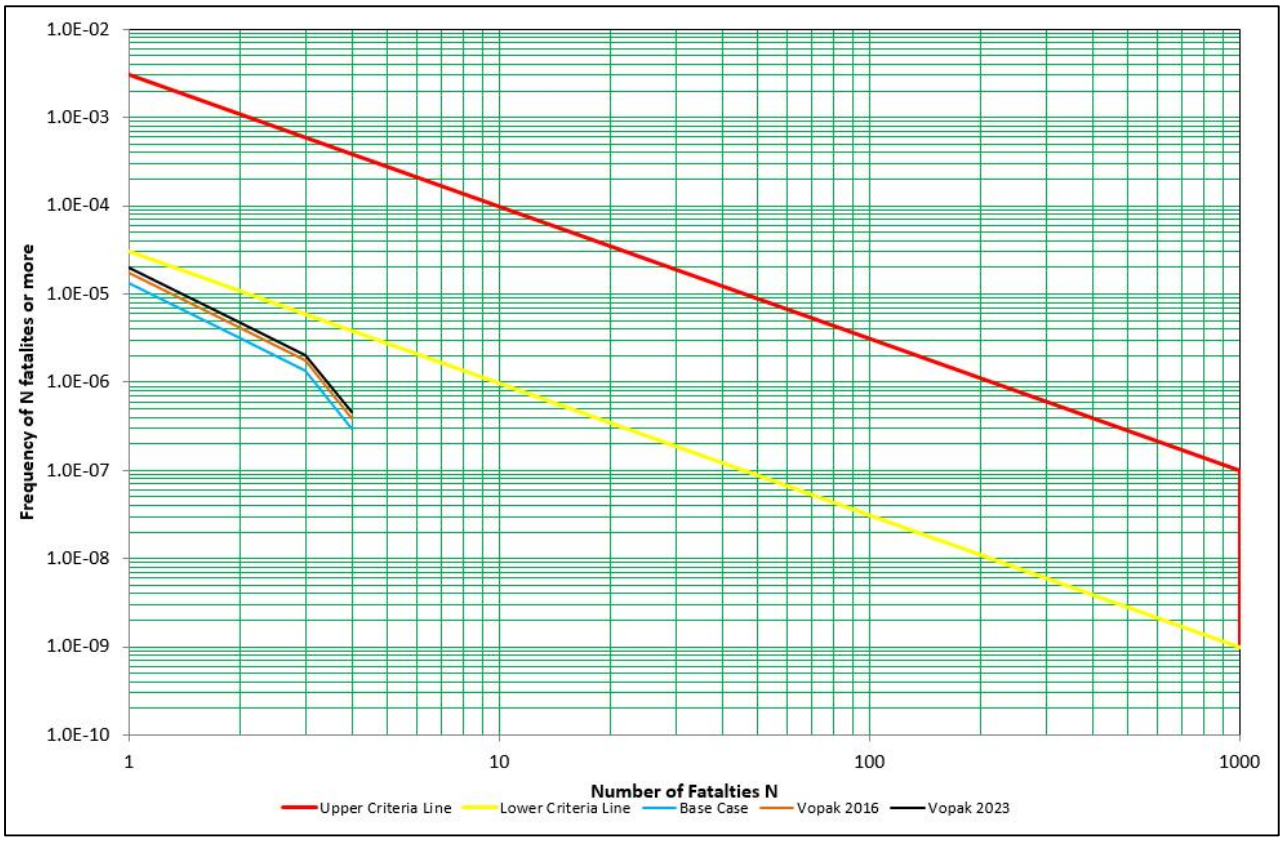

Figure 10. FN Curve for Vopak's tanker movements only

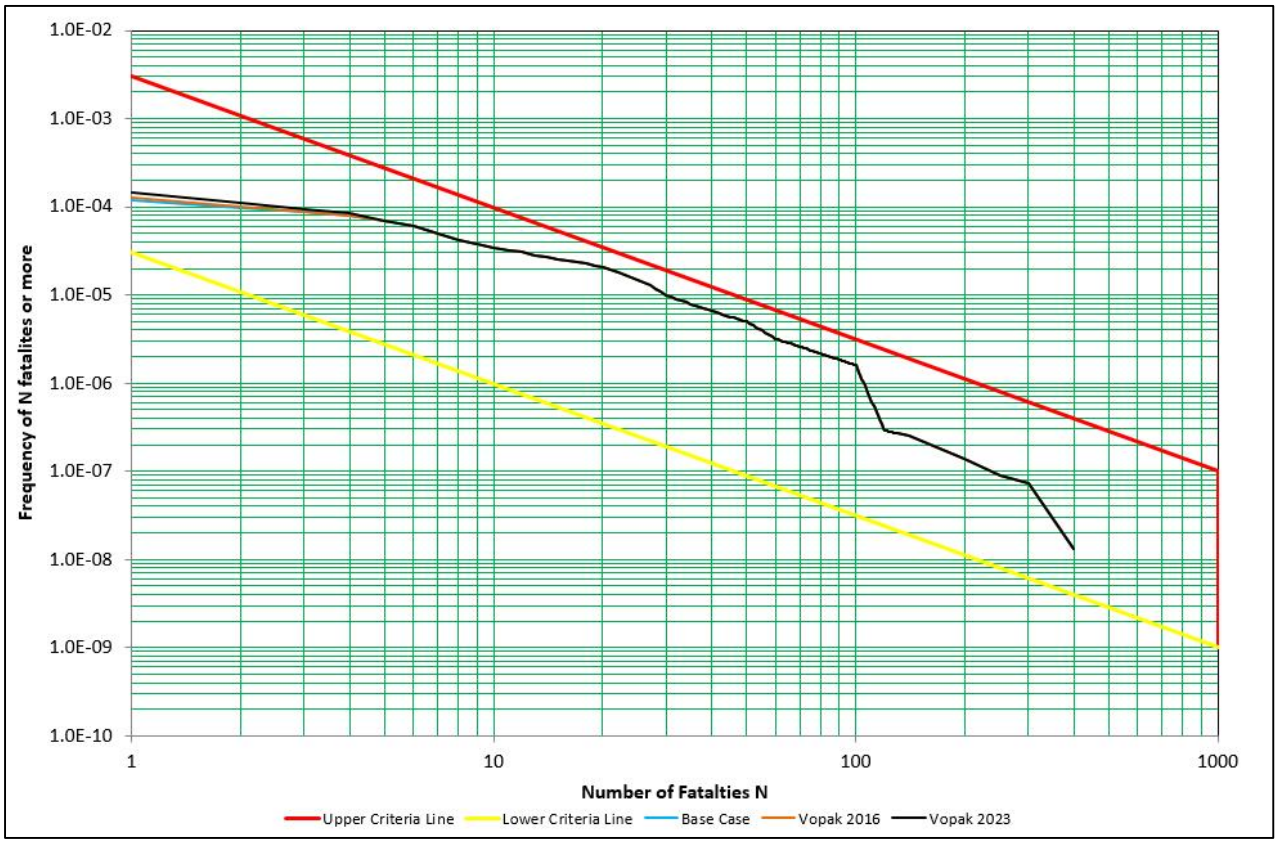

Figure 11. FN Curve for all DG movements on Denison St

A comparison of the F-N Curves showing the societal risk from all Dangerous Goods truck movements in a variety of cases is shown in Figure 7. This is the same as Figure 6, but with the addition of the 2015 addendum without the additional incremental increase in population identified in Section 2.1

The purple line represents the societal risk shown in the 2015 addendum, which is without the updated populations.

The three Vopak scenarios, all of which include the additional incremental increase in population identified in Section 2.1 are shown in black, orange and blue, as was the case in Figure 6.

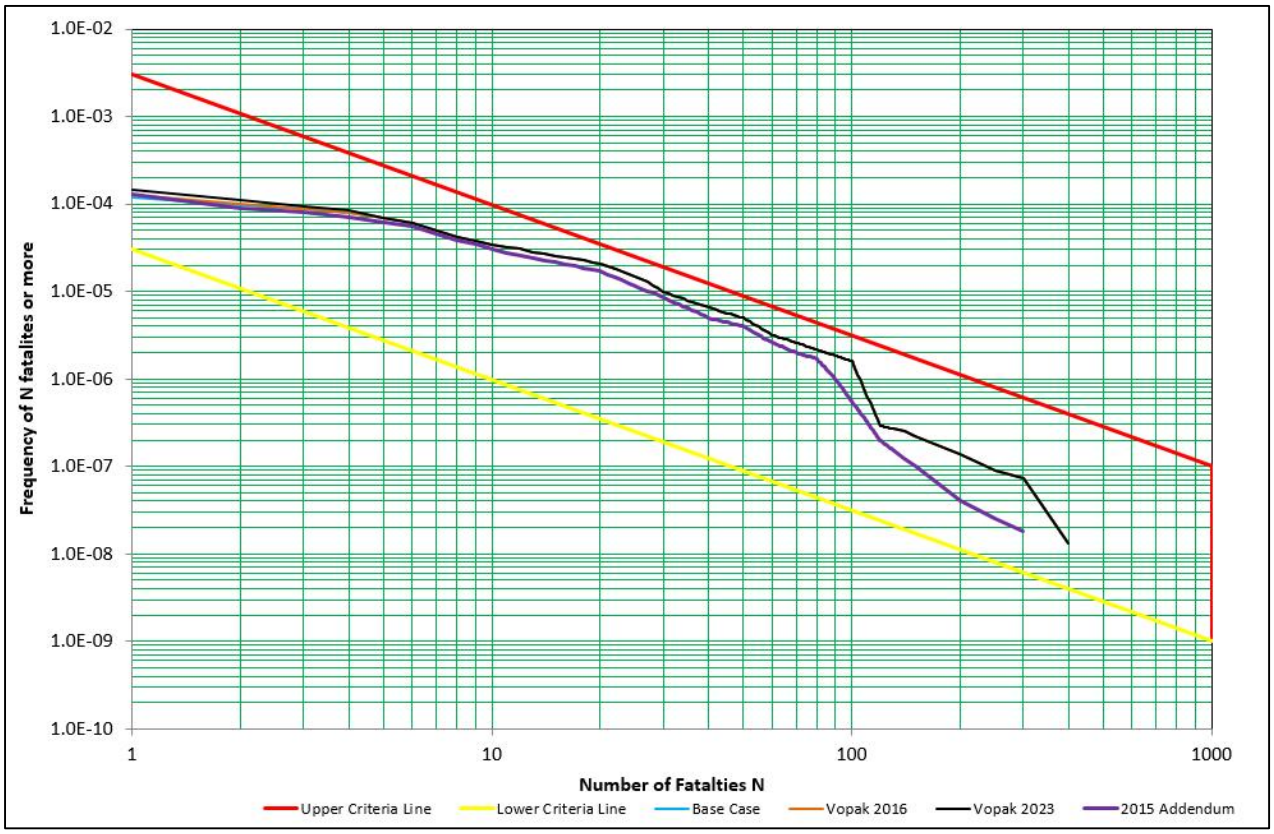

Figure 12. FN Curve for all DG movements on Denison St, including the 2015 addendum without the incremental increase in population

4. CONCLUSIONS

4.1 Individual Risk

As would be expected, the increased number of tanker movements results in small increases in individual risk, but only very close to the road. There is no increase in individual risk at distances of more than approximately 30m from the road. Around the road intersections, the risk in the existing 2015 Denison St Transport QRA reports is noted to exceed $1x10^{-5}$ per year (the red line on the contour diagrams). With the projected increase in Class 3 tanker movements, this localised risk is predicted to increase very slightly in the vicinity of intersections and the red contours on Figures 2, 4 & 6 can be seen to expand slightly.

The IFR Contours (Figures 3, 5 & 7) for Vopak's DG movements only show that Vopak's contribution to Individual Risk is extremely small and localised.

The DPE does not have any firm individual risk criteria for transport movements so it is hard to assess the acceptability of this small increase.

4.2 Societal Risk

As shown on the F-N Curves, under all three cases modelled, the risks from Class 3 Dangerous Goods movements *associated with Vopak alone* are very low and well below the yellow 'Negligible' line. It is noted that the recent increased populations in the area are more significant in pushing the FN curve closer to the limit of acceptability, not the estimated increase in Class 3 tankers from Vopak. Vopak's contribution ()in fact Class 3 road tankers generally) to societal risk lies at the 'lower fatalities' end of the FN curve, i.e. 1 to 4 fatalities, and does not contribute to the portion of the FN curve approaching the limit of acceptability.

In the words of HIPAP4: "Below the negligible line……societal risk is not considered significant" and "Provided the incremental societal risk lies within the negligible region, development should not be precluded". With reference to Figure 5, it is therefore concluded that the societal risk of the Vopak expansion in the vicinity of Denison St is low. Whilst it is the responsibility of government authorities to determine the acceptability of the risk in this situation, the risk would appear to be acceptable according to the principles of HIPAP4.

5. TERMS AND ABBREVIATIONS

The following defines the terms and abbreviations utilised throughout this document.

TERM	DESCRIPOTION
ALARP	As Low As Reasonably Practicable
BIP	Botany Industrial Park
DPE	Department of Environment and Planning
DG	Dangerous Goods
IFR	Individual Fatality Risk
QRA	Quantitative Risk Assessment

6. REFERENCES

NUMBER	REFERENCE	DATE
1	Scott Lister; *Dangerous Goods Transport QRA, Denison St, Hillsdale*	12 February 2015
2	Scott Lister; *Addendum To Dangerous Goods Transport QRA, Denison St, Hillsdale*	18 May 2015
3	NSW Department of Planning and Environment; *Hazardous industry Planning Advisory Planning No 4 – Risk Criteria for Land Use Safety Planning*	January 2011
4	Sherpa Consulting; *Site B Proposed Throughput Increase – Dangerous Goods Road Transport Risk Assessment*	July 2016